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Proposed Amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for K022. Volume 9

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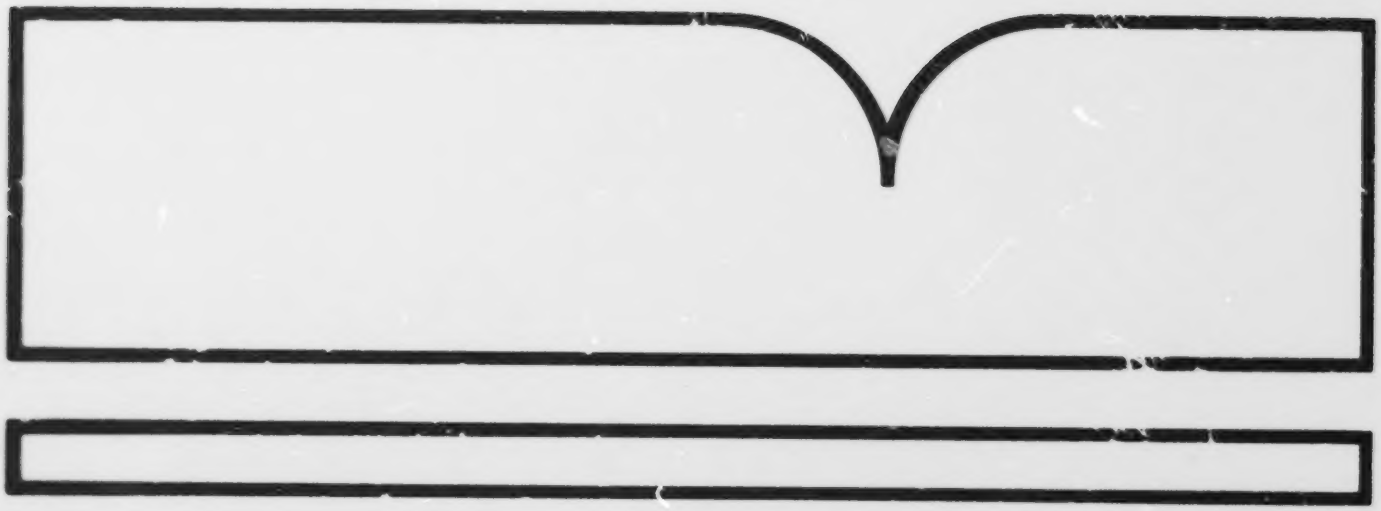

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This document presents (1) treatment performance data that were transferred to K022 and used to develop treatment standards for wastewater forms of K022; (2) EPA's rationale and technical support for selecting the constituents proposed for regulation in wastewater forms of K022; and (3) EPA's approach to and technical support for developing treatment standards for these constituents.

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PROPOSED

AMENDMENT TO THE

FINAL BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT FOR K022

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Note: This proposed Background Document is being issued in support of the Agency's proposed rulemaking for the land disposal restrictions program. The Agency solicits comments on the proposed rule and on this proposed Background Document. This document will be issued in final form, appropriately revised in response to comments, at the time of promulgation of the final rule.

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1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA or Agency) established best demonstrated available technology (BDAT) treatment standards for nonwastewater forms of the listed hazardous waste identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as K022, distillation bottom tars from the production of phenol/acetone from cumene. These BDAT treatment standards are being established in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. BDAT treatment standards will be effective no later than May 8, 1990, and on and after the effective date, compliance with these BDAT treatment standards is a prerequisite under 40 CFR Part 268 for placement of the waste in land disposal units.

The treatment standards established for nonwastewater forms of K022 were based on EPA-generated and industry-submitted treatment performance data from fuel substitution of K022. Because the treatment of K022 by these fuel substitution units did not generate wastewaters, and because the Agency had not identified any other sources of treatment performance data that may have been used to develop treatment standards for K022 wastewaters, the Agency did not issue treatment standards for wastewater forms of K022 in the final rule published in the Federal Register on August 17, 1988. Since that time, the Agency has identified treatment performance data that may be transferred to K022 to develop treatment standards for K022 wastewaters. Therefore, the Agency is proposing treatment standards for organic and metal constituents in

wastewater forms of K022 based on these data. The specific constituents proposed for regulation and the proposed treatment standards are listed in Table 1-1, at the end of this section. The treatment standards published on August 17, 1988 for organic and metal constituents in nonwastewater forms of K022 are not being revised at this time.

This amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for K022 presents (1) treatment performance data that were transferred to K022 and used to develop treatment standards for wastewater forms of K022; (2) EPA's rationale and technical support for selecting the constituents proposed for regulation in wastewater forms of K022; and (3) EPA's approach to and technical support for developing treatment standards for these constituents.

Sections 2.0 through 6.0 of this document amend discussions in the Final BDAT Background Document for K022 to discuss applicable and demonstrated treatment technologies, treatment performance data, accuracy-corrected data, constituents proposed for regulation in wastewater forms of K022, and calculation of proposed treatment standards, respectively. Section 7.0 contains acknowledgements and Section 8.0 lists references. Appendix A contains quality assurance/quality control data.

The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).

Table 1-1

PROPOSED BDAT TREATMENTS STANDARDS FOR K022

WASTEWATERS

BDAT List Constituent	Maximum for any Single Grab Sample Total Concentration (mg/L)
43. Toluene	0.017
53. Acetophenone	0.036
106./219. Diphenylamine/ Diphenylnitrosamine	0.036[a]
142. Phenol	0.091
159. Chromium (total)	0.35
163. Nickel	0.47

[a]This value represents the sum of the diphenylamine and diphenylnitrosamine concentrations.

2.0 AMENDMENT TO SECTION 3.0 (APPLICABLE/DEMONSTRATED TREATMENT TECHNOLOGIES) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 3.0 (Applicable/Demonstrated Treatment Technologies) of the Final BDAT Background Document for K022. This section discusses the technologies that are applicable to treatment of K022 wastewaters and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must theoretically be usable to treat the waste in question or a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to listed hazardous wastes are provided in EPA's Treatment Technology Background Document (Reference 2).) To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

2.1 Applicable Treatment Technologies

EPA is aware of one facility that generates K022 wastewater as incineration scrubber water and the Agency recognizes that K022 wastewaters may also be generated from treatment technologies other than incineration. Since these wastewaters may contain hazardous organic constituents at

treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following technologies as potentially applicable for treatment of organic constituents in K022 wastewaters: incineration, biological treatment, carbon adsorption, solvent extraction, and wet air oxidation. The Agency has also identified chemical precipitation followed by vacuum filtration as potentially applicable technologies for treatment of metal constituents in K022 wastewaters if dissolved metals are present at treatable concentrations. These technologies are briefly discussed below.

Incineration. Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste to destabilize chemical bonds and destroy organic constituents. In a fluidized bed incinerator, waste is injected into the fluidized bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln, and the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of organic waste constituents. Other wastes may also be injected into the afterburner.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. In general, only wastes with low or negligible ash content are amenable to liquid injection incineration. Therefore, this technology generally does not result in the generation of an ash residual.

Combustion gases from the incinerator are then fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, with the exception of liquid injection incineration, two residuals are generated by incineration processes: ash and scrubber water. Metals and other inorganic constituents in incinerator ash can be treated using stabilization. Metals and other inorganic constituents in scrubber water can be treated using chemical precipitation and filtration.

Biological Treatment. Biological treatment is a destruction technology in which organic constituents in wastewaters are biodegraded. This technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge may require further treatment for metals by chemical precipitation and stabilization, respectively.

Carbon Adsorption. Carbon adsorption is a separation technology in which organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology results in the formation of two treatment residuals: a treated effluent and spent activated carbon. The treated effluent may require further treatment for metals by chemical precipitation. The spent carbon may require further treatment by incineration.

Solvent Extraction. Solvent extraction is a separation technology in which organics are removed from the waste due to greater constituent solubility in the solvent phase than in the waste phase. This technology results in the generation of two treatment residuals: a treated waste residual and an extract. Metals and other inorganic constituents in the treated waste residual can be treated by stabilization. The extract may be recycled or further treated by incineration.

Wet Air Oxidation. Wet air oxidation is a destruction technology in which organic constituents in wastes are oxidized and destroyed under pressure at elevated temperatures in the presence of dissolved oxygen. This technology is applicable for wastes comprised primarily of water and up to 10% total organic concentration. Wet air oxidation results in the formation of one treatment residual: treated effluent. The treated effluent may require further treatment for organic constituents by carbon adsorption or PACT^{R} treatment, as described in this subsection. Emissions from wet air oxidation may require further treatment by incineration.

Chemical Precipitation and Vacuum Filtration. Chemical precipitation and vacuum filtration are separation technologies in which metals are precipitated and removed from wastewaters. These technologies result in the generation of two treatment residuals: a treated wastewater and a precipitate. The precipitate may require further treatment by stabilization.

PACT® Treatment. PACT treatment is the addition of powdered activated carbon to a biological treatment process. This technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge may require further treatment for metals by chemical precipitation and stabilization, respectively. In addition, the waste biosludge may require further treatment by incineration.

2.2 Demonstrated Treatment Technologies

The Agency is not aware of any facilities that treat organic constituents in K022 wastewaters. However, the Agency is aware of one facility that treats organic constituents in K022 by incineration and generates a scrubber water residual. Organic wastes, including wastes judged to be similar to K022, are commonly incinerated by industry. Because incineration is demonstrated for wastes judged to be similar to K022, incineration is considered to be demonstrated for treatment of K022, including wastewater forms of K022.

The Agency is not aware of any facilities that treat metal constituents in wastewater forms of K022. However, chemical precipitation followed by vacuum filtration is demonstrated for metal constituents in similar wastewaters, such as K062, as discussed in Section 3.0 of this document.

The Agency is not aware of any other technologies that are demonstrated for treatment of wastewater forms of K022.

3.0 AMENDMENT TO SECTION 4.0 (PERFORMANCE DATA BASE) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 4.0 (Performance Data Base) of the Final BDAT Background Document for K022. This section presents the treatment performance data that were used to develop proposed treatment standards for wastewater forms of K022.

Where data are not available on the treatment of the specific waste of concern, the Agency may elect to transfer performance data from a demonstrated tecnology that treats a similar waste or wastes. EPA's methodology for the transfer of treatment performance data is provided in the Agency's Methodology for Developing BDAT Treatment Standards (Reference 1). Transfer of treatment performance data is technically valid in cases where the untested wastes are generated from similar industries or similar processing steps, or have waste characteristics affecting treatment selection and performance that are similar to those of the tested wastes.

The Agency does not have any treatment performance data from treatment of wastewater forms of K022. However, treatment performance data were transferred from other wastes previously tested by EPA to develop proposed treatment standards for K022 wastewaters. Sources of treatment performance data for potential transfer to K022 wastewaters include wastes previously tested by rotary kiln, liquid injection, or fluidized-bed incineration, followed by chemical precipitation and vacuum filtration of scrubber water. These technologies were identified as applicable and

demonstrated for treatment of this waste, as discussed in Section 2.0 of this document.

3.1 Treatment of Organic Constituents

Previous incineration tests conducted by the Agency are listed in Table 3-1 at the end of this section. EPA examined these wastes to identify the best data source(s), if any, for transfer of treatment performance data to organic constituents in K022 wastewaters. Specifically, EPA examined (1) whether the untested waste is generated from a similar industry or processing step and (2) whether the waste has similar waste characteristics affecting treatment performance as those previously-tested wastes.

Wastes included in Tests 3, 4, 5, 11, 12, 13, and 14 are generated by the organic chemicals industry. K022 is also generated by the organic chemicals industry. Unlike the wastes previously tested, however, K022 is generated as distillation bottom tars in the production of phenol and acetone. K022 consists mainly of organic constituents and has low concentrations of metals. Although the wastes incinerated in Tests 13 and 14 are not generated as distillation bottom tars, they are similar to K022 in that all are organic wastes with low concentrations of metal constituents. Two of the constituents in the wastes incinerated in Test 14 were also quantified in K022. In addition, these constituents were included in Test 14 at percent levels.

As discussed in the Treatment Technology Background Document (Reference 2), waste characteristics that affect treatment performance for

incineration include the thermal conductivity of the waste and the boiling points and bond dissociation energies of the constituents of concern. Because K022 contains constituents similar to those incinerated in Test 14, they would have similar thermal conductivity, boiling points, and bond dissociation energies, and therefore, similar treatment performance could be achieved.

Because of the similarities discussed above, treatment standards for constituents being proposed for regulation in K022 wastewaters were developed based on treatment performance data transferred from rotary kiln incineration of surrogate wastes for U141, U028, P020, U112, U226, U239, U080, U220, U166, U161, and U188 in Test 14.

Surrogate wastes for U141, U028, P020, U112, U226, U239, U080, U220, U166, U161, and U188 were incinerated in the Third Third Incineration Treatability Test (Reference 3). All of these wastes, along with clean fill soil, were fed to the rotary kiln. The ash and scrubber water generated from rotary kiln incineration result from treatment of these wastes. Table 3-2 presents the BDAT List constituents detected in the untreated wastes collected by EPA from the rotary kiln incineration treatment system used in Test 14. Table 3-3 presents the BDAT List constituents detected in the scrubber water residual from Test 14. Design and operating data for the rotary kiln and secondary combustor used in Test 14 are presented in Table 3-4. Additional details of this test may be found in the Onsite Engineering Report for the Third Thirds Incineration Treatment Test (Reference 3).

3.2 Treatment of Metal Constituents

EPA's database for chemical precipitation in wastewaters is included in the California List Notice of Data Availability (Reference 4). Data are available for chemical precipitation and vacuum filtration of K062 mixed with metal-bearing characteristic hazardous wastes (Reference 5). Data are also available for chromium reduction followed by lime and sulfide precipitation and vacuum filtration for K062 mixed with metal-bearing characteristic hazardous wastes. However, since K022 is not known to contain hexavalent chromium, and therefore hexavalent chromium treatment is not necessary, the data for chromium reduction followed by lime and sulfide precipitation and vacuum filtration were not considered. EPA screened the available data to determine whether any wastes are generated from similar industries or similar processing steps, or have similar waste characteristics as those expected for scrubber water generated from the incineration of K022. The metal constituents of concern in K022 are chromium and nickel, as shown by the waste characterization data included in the Final BDAT Background Document for K022. Based on waste characterization data, the K062 mixed with metal-bearing characteristic hazardous wastes and K022 scrubber water are expected to contain the constituents of concern at similar concentrations.

EPA then examined the relative treatability of K022 scrubber water and the mixture of K062 and metal-bearing characteristic hazardous wastes. As discussed in the Technology Treatment Background Document (Reference 2), waste characteristics that affect treatment performance for chemical precipitation include the concentrations and types of metals in the waste, the

concentrations of dissolved solids in the waste, the oil and grease content of the waste, and whether the metals exist in the wastewater as a complex. As discussed above, both K022 and the K062 mixture are expected to contain the constituents of concern. EPA considers K062 wastewaters to be more difficult to treat than K022 wastewaters because equal or higher concentrations of metals and dissolved solids are anticipated in K062 than in scrubber water from incineration of K022. These higher concentrations of metals and dissolved solids would interfere more with the effectiveness of the precipitation reactions intended to remove the metals of concern. Since K022 scrubber water is generated from incineration, oil and grease would not be expected to be present at significant concentrations. However, the K062 mixture contains oil and grease and may therefore be more difficult to treat than K022 scrubber water. Complex metals are not considered to be significant parameters in either waste. Based on consideration of these points, the mixture of K062 and metal-bearing characteristic hazardous wastes is considered to be more difficult to treat than wastewater forms of K022.

Based on these analyses, transfer of treatment performance data from chemical preciptiation and vacuum filtration of K062 mixed with metal-bearing characteristic hazardous wastes to K022 wastewaters was judged to be valid. Treatment performance data for lime and sulfide precipitation followed by filtration from K062 mixed with metal-bearing characteristic hazardous wastes are included in Table 3-5.

Table 3-1

WASTES TESTED BY INCINERATION AND SAMPLED BY EPA

Test Number	Waste Code(s)	Treatment Technology Used
1	K001-Pentachlorophenol waste	Rotary kiln incineration
2	K001-Creosote waste	Rotary kiln incineration
3	K011, K013, K014	Rotary kiln incineration
4	K019	Rotary kiln incineration
5	K024	Rotary kiln incineration
6	K037	Rotary kiln incineration
7	K048, K051	Fluidized bed incineration
8	K087	Rotary kiln incineration
9	K101	Rotary kiln incineration
10	K102	Rotary kiln incineration
11	F024	Rotary kiln incineration
12	K015	Liquid injection incineration
13	D014, D016, P059,* U127,* and U192*	Rotary kiln incineration
14	U141,* U028,* P020,* U112,* U226,* U239,* U080,* U220,* U166,* U161,* and U188*	Rotary kiln incineration

*Commerical chemical products were used in these test burns as surrogates for these wastes.

Table 3-2

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR
WASTES INCINERATED IN TEST 14

BDAT List Constituent	Concentration in the Untreated Waste Fed to the Rotary Kiln (ppm) MIX-L[a]
VOLATILE ORGANICS	
38. Methylene chloride	87,000
229. Methyl isobutyl ketone	52,000
43. Toluene	69,000
45. 1,1,1-Trichloroethane	130,000
SEMIVOLATILE ORGANICS	
70. Bis(2-ethylhexyl)phthalate	28,000
73. Dinoseb	77,000
117. Isosafrole	35,000
122. 1,4-Naphthoquinone	9,900
142. Phenol	13,000
METALS	
156. Barium	0.42
158. Cadmium	1.2
159. Chromium (total)	1.2
160. Copper	9.8
161. Lead	4.4
163. Nickel	2.0
168. Zinc	17.3
INORGANICS	
169. Cyanide	3.56
170. Fluoride	0.1

[a]MIX-L consisted of U141, U028, P020, U112, U226, U239, U080, U220, U166, U161, and U188.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

Table 3-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA
FOR WASTES INCINERATED IN TEST 14

SCRUBBER WATER RESIDUAL

Concentration in Scrubber Water - Total Concentration (mg/l)

BDAT List Constituent	Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4
METALS				
154. Antimony	0.285	NA	NA	NA
155. Arsenic	0.348	NA	NA	NA
156. Barium	0.131	NA	NA	NA
158. Cadmium	0.0618	NA	NA	NA
159. Chromium (total)	5.38	NA	NA	NA
160. Copper	2.91	NA	NA	NA
161. Lead	2.48	NA	NA	NA
162. Mercury	0.00038	NA	NA	NA
163. Nickel	2.46	NA	NA	NA
165. Silver	0.0139	NA	NA	NA
166. Thallium	0.013	NA	NA	NA
167. Vanadium	0.0636	NA	NA	NA
168. Zinc	3.350	NA	NA	NA
INORGANICS				
170. Fluoride	23	25	NA	NA
171. Sulfide	11.8	NA	NA	NA

NA - Not analyzed.

Note: This table shows the concentrations in the scrubber water for all constituents that were detected in the wastewater residuals generated from treatment of the waste.

Source: Onsite Engineering Report for the Third Thirds Incineration Test Treatability Test (Reference 3).

Table 3-4

DESIGN AND OPERATING DATA FOR THE ROTARY KILN AND SECONDARY COMBUSTOR USED IN TEST 14

Time of Data Collection	Corresponding Sample Set	Kiln Temperature (°F)	Clean Fill Soil Feed Rate (lbs/hr)	Liquids Mixture Feed Rate (gal/hr)	Kiln Rotational Speed (rpm)	Natural Gas (Auxiliary Fuel) Feed Rate (ft^3/min)

0830	pre-test	1600-1800	540	0	0.25	10
0915	begin liquid feed	1600-1800	NR	24	NR	NR
0930	pre-test	1600-1800	540	28	0.25	7.3
1000	pre-test	1600-1800	540	28	0.25	7.3
1055	sample set #1	1700	540	28	0.25	6.4
1145	sample set #2	1700	540	28	0.25	6.4
1215	sample set #2	1700	540	28	0.25	5.9
1245	sample set #3	1700	540	28	0.25	5.9
1315	sample set #3	1700	540	28	0.25	5.9
1345	sample set #4	1700-1800	540	28	0.25	5.7
1410	kiln shut off	1800	NR	NR	0.25	NR

Source: Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

NR - Not reported.

Table 3-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR TREATMENT OF K062 BY CHEMICAL PRECIPITATION FOLLOWED BY VACUUM FILTRATION[a]

BDAT LIST METAL CONSTITUENT	Sample Set #8		Sample Set #11		Sample Set #12	
	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)
154. Antimony	<10	<1	<10	<1	<10	<1.00
155. Arsenic	<1	<0.1	<1	<0.1	<1	<0.10
156. Barium	<10	<1	<10	<1	12	<1.00
157. Beryllium	<2	<0.2	<2	<0.2	<2	<0.20
158. Cadmium	<5	<0.5	<5	<0.5	23	<5
221. Chromium (hexavalent)	0.13	<0.01	0.08	0.106	0.30	<0.01
159. Chromium (total)	831	0.15	395	0.12	617	0.18
160. Copper	217	0.16	191	0.14	137	0.24
161. Lead	212	<0.01	<10	<0.01	136	<0.01
162. Mercury	<1	<0.1	<1	<0.1	<1	<0.10
163. Nickel	669	0.36	712	0.33	382	0.39
164. Selenium	<10	<1	<10	<1	<10	<1.00
165. Silver	<2	<0.2	<2	<0.2	<2	<0.20
166. Thallium	<10	<1	<10	<1	<10	<1.00
168. Zinc	151	0.130	5	0.070	135	0.100

[a]Only 3 of the 12 data sets analyzed at Plant B represented treatment by this treatment train. Other data sets included pretreatment technologies such as chromium reduction and treatment for cyanide. These data are not included here, since they were not considered for transfer, as discussed in Section 3.2 of this document.

Source: Envirite Onsite Engineering Report (Reference 5).

4.0 AMENDMENT TO SECTION 5.2 (IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY-WASTEWATER) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 5.2 (Identification of Best Demonstrated Available Technology-Wastewater) of the Final BDAT Background Document for K022. This section discusses technologies that are available for treatment of K022 wastewaters and identifies proposed BDAT for K022 wastewaters.

For a treatment technology to be identified as BDAT, the treatment performance data are first screened to determine whether they represent a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data, and whether the appropriate measures of performance were used to assess the performance of the particular treatment technology.

The treatment performance data and the design and operating data collected during the tests of rotary kiln incineration and chemical precipitation followed by vacuum filtration were reviewed for the points described above. For both of these tests, the appropriate measure of performance (total constituent concentration) was used to assess the treatment systems. Additionally, the Agency had no reason to believe that these treatment systems were not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

An available treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (i.e., it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste. Incineration and chemical precipitation followed by vacuum filtration, technologies that are demonstrated for treatment of K022 wastewaters, are considered to be commercially available and to provide substantial treatment of the waste. Therefore, these treatment technologies are "available" for treatment of wastewater forms of K022.

In summary, rotary kiln incineration followed by chemical precipitation and vacuum filtration of the scrubber water have been determined to be demonstrated and available for treatment of wastewater forms of K022. However, because the Agency does not have treatment performance data for any other demonstrated and available technologies treating K022 wastewaters or similar wastes, this treatment train is considered to be the best. Therefore, the best demonstrated available technology (BDAT) for wastewater forms of K022 has been determined to be rotary kiln incineration followed by chemical precipitation and vacuum filtration of the scrubber water.

5.0 AMENDMENT TO SECTION 6.2 (SELECTION OF REGULATED CONSTITUENTS-CONSTITUENT SELECTION) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 6.2 (Selection of Regulated Constituents-Constituent Selection) of the Final BDAT Background Document for K022. This section includes a discussion of the selection of organic and metal constituents for proposed regulation in wastewater forms of K022.

Generally, constituents selected for regulation must satisfy the following criteria:

(1) The constituent must be on the BDAT List of regulated constituents. Presence on the BDAT List means that approved methods to analyze for the constituent in treated waste matrices exist.

(2) The constituent must be present in, or be suspected of being present in, the untreated waste. For example, in some cases, analytical difficulties (such as masking) may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.

From a group of constituents that are eligible for regulation, because they meet the above criteria, EPA may select a subset of constituents that represent the broader group. For example, from a group of constituents that react similarly to treatment, the Agency may select for regulation only those constituents that are (1) the most difficult to treat, based on waste characteristics affecting performance of treatment; (2) are representative of

other constituents in the waste, based on structural similarities; and (3) are present in the untreated waste in the highest concentrations. Selecting a subset of constituents for regulation is done to facilitate implementation of the compliance and enforcement program.

The Agency initially considered all constituents on the BDAT List for regulation. Table 5-1, at the end of this section, summarizes available waste characterization data for K022. If an analysis for a constituent was performed but the constituent was not detected in the waste, the table indicates "ND" for that constituent. If the constituent was analyzed for and quantified at or above the detection limit, the table indicates "D" for that constituent. Constituents for which no analyses were performed are identified by "NA" (not analyzed). If a constituent is believed to be present in the waste even if the characterization data do not indicate that it was detected, this is indicated in the "Believed to be Present" column in Table 5-1. Constituents marked with "Y" have been detected in the treated residual(s); thus, EPA believes they are present in the untreated waste even though they were not detected. Constituents may not have been detected in the untreated waste for several reasons. For example, the untreated waste samples may not have been analyzed for those constituents or interferences by other constituents may have prevented detection. It is important to note that some hazardous wastes are generated from a process that may utilize variable raw materials composed of different constituents. Therefore, all potentially regulated constituents would not necessarily be present in any given sample. For example, Plants 1 and 2 may both generate K022 as distillation bottoms from the production of phenol/acetone from cumene. However, Plant 1 may use

raw materials A and B, while Plant 2 may use raw materials C and D. Because of the differences in the composition of the raw materials, K022 generated by Plant 1 may contain different constituents at different concentrations from the K022 generated by Plant 2.

5.1 BDAT List Constituents Not Selected For Proposed Regulation

The Agency is not regulating all of the BDAT List constituents initially considered for regulation. As discussed further below, a BDAT List constituent was deleted from further consideration for proposed regulation if: (1) the constituent was not detected in the untreated waste and is not suspected of being present in the waste; (2) the constituent was not analyzed for in the untreated waste; or (3) other reasons, as discussed below. BDAT List constituents that remained following the deletions described in this subsection were further considered for regulation. These constituents were further considered for regulation and are listed in Table 5-2 at the end of this section.

BDAT List Constituents That Were Not Detected in the Untreated Waste. BDAT List constituents that were not detected or suspected of being present in the untreated waste (labelled "ND" in Table 5-1) were deleted from consideration for proposed regulation.

BDAT List Constituents That Were Not Analyzed for in the Untreated Waste. Some BDAT List constituents were deleted from consideration for proposed regulation because they were not analyzed for in the untreated waste

(labelled "NA" in Table 5-1). Some constituents were not analyzed for in the untreated waste because it was extremely unlikely that these constituents would be present in the waste, based on knowledge of the process generating the waste.

BDAT List Constituents That Were Deleted From Consideration for Proposed Regulation for Other Reasons. Copper, vanadium, and zinc were considered for proposed regulation in K022 wastewaters but were not selected as constituents to be proposed for regulation. Although copper cyanide, vandium pentoxide, and zinc cyanide are listed in Appendix VIII of 40 CFR Part 261, the metals are not listed individually. The Agency is only proposing to regulate copper, vanadium, and/or zinc when they are indicators of performance of treatment for other Appendix VIII constituents. For K022 wastewaters, copper, vanadium, and zinc have not been identified as indicators of treatment performance for other Appendix VIII constituents and therefore, are not being proposed for regulation.

Fluoride and sulfide were deleted from consideration for proposed regulation in K022 wastewaters because the technology determined to be BDAT for K022 wastewaters (incineration followed by chemical precipitation and vacuum filtration) does not provide effective treatment for these BDAT List constituents. Moreover, the Agency is unaware of any demonstrated technology for treatment of fluoride and sulfide in wastewater forms of K022 or similar wastes.

Barium was deleted from consideration for proposed regulation in K022 wastewaters because the BDAT treatment performance data transferred from chemical precipitation followed by vacuum filtration of K062 do not show effective treatment.

Tetrachlorodibenzofurans were deleted from consideration for proposed regulation because the accuracy of the quantification for these constituents could not be determined due to incomplete quality assurance/quality control information.

5.2 Selection of BDAT List Constituents for Proposed Regulation

Constituents considered further for proposed regulation in wastewater forms of K022 were selected from the BDAT List constituents that were detected in the untreated waste, unless they were deleted from consideration as discussed in Section 5.1. The constituents that remained following the deletions discussed in Section 5.1 are listed in Table 5-2 of this document.

Table 5-3 presents each constituent selected for proposed regulation in K022 wastewaters after consideration of (1) the constituent concentration in the untreated waste, (2) whether the constituent is adequately controlled by regulation of another constituent, and (3) the relative difficulty in achieving effective treatment of the constituent by the technology identified as BDAT for K022 wastewaters (incineration followed by chemical precipitation and vacuum filtration).

The Agency's determination of adequate control for organic constituents was based on (1) an evaluation of the characteristics of the constituents that would affect the performance of incineration relative to the scrubber water residual, specifically, their estimated bond dissociation energies, and (2) the structural similarities among the constituents.

Twelve BDAT List organic constituents (shown in Table 5-2) were further considered for proposed regulation in wastewater forms of K022 due to their presence in the untreated waste. The bond dissociation energies of these twelve constituents, and their concentrations in the untreated waste were compared to determine which constituents had higher bond dissociation energies and higher concentrations in the untreated waste. Seven constituents were then deleted from consideration for proposed regulation because (1) they are believed to be adequately controlled by incineration of the five remaining organic constituents in K022 wastewaters and/or (2) they are believed to be treated to similar concentrations as the five remaining constituents based on structural similarities.

Based on the above discussion, the five BDAT List organic constituents selected for proposed regulation in K022 wastewaters (shown in Table 5-3) are toluene, acetophenone, diphenylamine, diphenylnitrosamine, and phenol.

Two metal constituents, chromium and nickel, were selected for proposed regulation in wastewater forms of K022. All other BDAT List metal

constituents initially considered for proposed regulation in K022 wastewaters were not selected because these constituents were found (or suspected to be present) at low concentrations in the untreated waste and are believed to be adequately controlled by the proposed treatment standards for total chromium and nickel. By removing the metals present (or expected to be present) at the highest concentrations in the untreated waste (chromium and nickel in this case) using chemical precipitation followed by vacuum filtration, adequate treatment is expected to be provided for other metals present at lower treatable concentrations.

Table 5-1

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Volatile Organics		
222. Acetone	D (CBI)	
1. Acetonitrile	ND	
2. Acrolein	ND	
3. Acrylonitrile	ND	
4. Benzene	ND	
5. Bromodichloromethane	ND	
6. Bromomethane	ND	
223. n-Butyl alcohol	NA	
7. Carbon tetrachloride	ND	
8. Carbon disulfide	ND	
9. Chlorobenzene	ND	
10. 2-Chloro-1,3-butadiene	ND	
11. Chlorodibromomethane	ND	
12. Chloroethane	ND	
13. 2-Chloroethyl vinyl ether	ND	
14. Chloroform	ND	
15. Chloromethane	ND	
16. 3-Chloropropene	ND	
17. 1,2-Dibromo-3-chloropropane	ND	
18. 1,2-Dibromoethane	ND	
19. Dibromomethane	ND	
20. trans-1,4-Dichloro-2-butene	ND	
21. Dichlorodifluoromethane	ND	
22. 1,1-Dichloroethane	ND	
23. 1,2-Dichloroethane	ND	
24. 1,1-Dichloroethylene	ND	
25. trans-1,2-Dichloroethene	ND	
26. 1,2-Dichloropropane	ND	
27. trans-1,3-Dichloropropene	ND	
28. cis-1,3-Dichloropropene	ND	
29. 1,4-Dioxane	ND	
224. 2-Ethoxyethanol	NA	
225. Ethyl acetate	NA	
226. Ethyl benzene	D (CBI)	
30. Ethyl cyanide	ND	
227. Ethyl ether	NA	
31. Ethyl methacrylate	ND	
214. Ethylene oxide	NA	
32. Iodomethane	ND	
33. Isobutyl alcohol	ND	
228. Methanol	NA	
34. Methyl ethyl ketone	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Volatile Organics (Continued)		
229. Methyl isobutyl ketone	NA	
35. Methyl methacrylate	ND	
37. Methacrylonitrile	ND	
38. Methylene chloride	D (CBI)	
230. 2-Nitropropane	NA	
39. Pyridine	ND	
40. 1,1,1,2-Tetrachloroethane	ND	
41. 1,1,2,2-Tetrachloroethane	ND	
42. Tetrachloroethene	ND	
43. Toluene	D (CBI)	
44. Tribromomethane	ND	
45. 1,1,1-Trichloroethane	ND	
46. 1,1,2-Trichloroethane	ND	
47. Trichloroethene	ND	
48. Trichloromonofluoromethane	ND	
49. 1,2,3-Trichloropropane	ND	
231. 1,1,2-Trichloro-1,2,2-trifluoroethane	NA	
50. Vinyl chloride	ND	
215. 1,2-Xylene	NA	
216. 1,3-Xylene	NA	
217. 1,4-Xylene	NA	
Semivolatile Organics		
51. Acenaphthalene	ND	
52. Acenaphthene	ND	
53. Acetophenone	D (CBI)	
54. 2-Acetylaminofluorene	ND	
55. 4-Aminobiphenyl	ND	
56. Aniline	ND	
57. Anthracene	ND	
58. Aramite	ND	
59. Benz(a)anthracene	ND	
218. Benzal chloride	NA	
60. Benzenethiol	ND	
61. Deleted		
62. Benzo(a)pyrene	ND	
63. Benzo(b)fluoranthene	ND	
64. Benzo(ghi)perylene	ND	
65. Benzo(k)fluoranthene	ND	
66. p-Benzoquinone	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Semivolatile Organics (Continued)		
67. Bis(2-chloroethoxy)methane	ND	
68. Bis(2-chloroethyl)ether	ND	
69. Bis(2-chloroisopropyl)ether	ND	
70. Bis(2-ethylhexyl)phthalate	ND	
71. 4-Bromophenyl phenyl ether	ND	
72. Butyl benzyl phthalate	ND	
73. 2-sec-Butyl-4,6-dinitrophenol	ND	
74. p-Chloroaniline	ND	
75. Chlorobenzilate	ND	
76. p-Chloro-m-cresol	ND	
77. 2-Chloronaphthalene	ND	
78. 2-Chlorophenol	ND	
79. 3-Chloropropionitrole	ND	
80. Chrysene	ND	
81. ortho-Cresol	ND	
82. para-Cresol	ND	
232. Cyclohexanone	NA	
83. Dibenz(a,h)anthracene	ND	
84. Dibenzo(a,e)pyrene	ND	
85. Dibenzo(a,i)pyrene	ND	
86. m-Dichlorobenzene	ND	
87. o-Dichlorobenzene	ND	
88. p-Dichlorobenzene	ND	
89. 3,3'-Dichlorobenzidine	ND	
90. 2,4-Dichlorophenol	ND	
91. 2,6-Dichlorophenol	ND	
92. Diethyl phthalate	ND	
93. 3,3'-Dimethoxybenzidine	ND	
94. p-Dimethylaminoazobenzene	ND	
95. 3,3'-Dimethylbenzidine	ND	
96. 2,4-Dimethylphenol	ND	
97. Dimethyl phthalate	ND	
98. Di-n-butyl phthalate	ND	
99. 1,4-Dinitrobenzene	ND	
100. 4,6-Dinitro-o-cresol	ND	
101. 2,4-Dinitrophenol	ND	
102. 2,4-Dinitrotoluene	ND	
103. 2,6-Dinitrotoluene	ND	
104. Di-n-octyl phthalate	ND	
105. Di-n-propylnitrosamine	ND	
106./219. Diphenylamine/Diphenylnitrosamine	D (CBI)	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Semivolatile Organics (Continued)		
107. 1,2-Diphenylhydrazine	ND	
108. Fluoranthene	ND	
109. Fluorene	ND	
110. Hexachlorobenzene	ND	
111. Hexachlorobutadiene	ND	
112. Hexachlorocyclopentadiene	ND	
113. Hexachloroethane	ND	
114. Hexachlorophene	ND	
115. Hexachloropropene	ND	
116. Indeno(1,2,3-cd)pyrene	ND	
117. Isosafrole	ND	
118. Methapyrilene	ND	
119. 3-Methylcholanthrene	ND	
120. 4,4'-Methylenebis(2-chloroaniline)	ND	
36. Methyl methanseulfonate	ND	
121. Naphthalene	ND	
122. 1,4-Naphthoquinone	ND	
123. 1-Naphthylamine	ND	
124. 2-Naphthylamine	ND	
125. p-Nitroaniline	ND	
126. Nitrobenzene	ND	
127. 4-Nitrophenol	ND	
128. n-Nitrosodi-n-butylamine	ND	
129. n-Nitrosodiethylamine	ND	
130. n-Nitrosodimethylamine	ND	
131. n-Nitrosomethylethylamine	ND	
132. n-Nitrosomorpholine	ND	
133. n-Nitrosopiperidine	ND	
134. n-Nitrosopyrrolidine	ND	
135. 5-Nitro-o-toluidine	ND	
136. Pentachlorobenzene	ND	
137. Pentachloroethane	ND	
138. Pentachloronitrobenzene	ND	
139. Pentachlorophenol	ND	
140. Phenacetin	ND	
141. Phenanthrene	ND	
142. Phenol	D (CBI)	
220. Phthalic anhydride	NA	
143. 2-Picoline	ND	
144. Pronamide	ND	
145. Pyrene	ND	
146. Resorcinol	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Semivolatile organics (Continued)		
147. Safrole	ND	
148. 1,2,4,5-Tetrachlorobenzene	ND	
149. 2,3,4,6-Tetrachlorophenol	ND	
150. 1,2,4-Trichlorobenzene	ND	
151. 2,4,5-Trichlorophenol	ND	
152. 2,4,6-Trichlorophenol	ND	
153. Tris(2,3-dibromopropyl)phosphate	ND	
Metals		
154. Antimony	ND	
155. Arsenic	ND	Y
156. Barium	ND	Y
157. Beryllium	ND	Y
158. Cadmium	ND	Y
159. Chromium (total)	D (CBI)	
221. Chromium (hexavalent)	NA	
160. Copper	ND	Y
161. Lead	ND	Y
162. Mercury	ND	
163. Nickel	ND	Y
164. Selenium	ND	
165. Silver	ND	
166. Thallium	ND	Y
167. Vanadium	ND	Y
168. Zinc	ND	Y
Inorganics other than metals		
169. Cyanide	ND	
170. Fluoride	D (CBI)	
171. Sulfide	D (CBI)	
Organochlorine pesticides		
172. Aldrin	ND	
173. alpha-BHC	ND	
174. beta-BHC	D (CBI)	
175.	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Organochlorine pesticides		
176. gamma-BHC	ND	
177. Chlordane	ND	
178. DDD	ND	
179. DDE	ND	
180. DDT	ND	
181. Dieldrin	D (CBI)	
182. Endosulfan I	ND	
183. Endosulfan II	D (CBI)	
184. Endrin	ND	
185. Endrin aldehyde	ND	
186. Heptachlor	D (CBI)	
187. Heptachlor epoxide	ND	
188. Isodrin	ND	
189. Kepone	ND	
190. Methoxychlor	ND	
191. Toxaphene	ND	
Phenoxyacetic acid herbicides		
192. 2,4-Dichlorophenoxyacetic acid	ND	
193. Silvex	ND	
194. 2,4,5-T	ND	
Organophosphorous insecticides		
195. Disulfoton	ND	
196. Famphur	ND	
197. Methyl parathion	ND	
198. Parathion	ND	
199. Phorate	ND	
PCBs		
200. Aroclor 1016	ND	
201. Aroclor 1221	ND	
202. Aroclor 1232	ND	
203. Aroclor 1242	ND	
204. Aroclor 1248	ND	
205. Aroclor 1254	ND	
206. Aroclor 1260	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
Source: CBI Background Document for K022. (Reference 6).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent	Detection Status	Believed To Be Present
Dioxins and furans		
207. Hexachlorodibenzo-p-dioxins	ND	
208. Hexachlorodibenzofurans	ND	
209. Pentachlorodibenzo-p-dioxins	ND	
210. Pentachlorodibenzofurans	ND	
211. Tetrachlorodibenzo-p-dioxins	ND	
212. Tetrachlorodibenzofurans	D (CBI)	
213. 2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information (CBI).
ND - Not detected.
Source: CBI Background Document for K022. (Reference 6).

Table 5-2

BDAT LIST CONSTITUENTS FURTHER CONSIDERED FOR PROPOSED REGULATION[a] IN K022 WASTEWATERS AFTER INITIAL SCREENING

222.	Acetone
226.	Ethylbenzene
38.	Methylene chloride
43.	Toluene
53.	Acetophenone
106./219.	Diphenylamine/Diphenylnitrosamine
142.	Phenol
155.	Arsenic
157.	Beryllium
158.	Cadmium
159.	Chromium (total)
161.	Lead
163.	Nickel
166.	Thallium
174.	beta-BHC
181.	Dieldrin
183.	Endosulfan II
185.	Endrin aldehyde

[a]All constituents on this list were detected in untreated K022 and were either selected for proposed regulation (as shown in Table 5-3) or are believed to be controlled by regulation of another constituent.

Table 5-3

BDAT LIST CONSTITUENTS SELECTED FOR PROPOSED REGULATION IN K022 WASTEWATERS

43.	Toluene
53.	Acetophenone
106./219.	Diphenylamine/Diphenylnitrosamine
142.	Phenol
159.	Chromium (total)
163.	Nickel

6.0 AMENDMENT TO SECTION 7.2 (CALCULATION OF BDAT TREATMENT STANDARDS-WASTEWATER) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 7.2 (Calculation of BDAT Treatment Standards-Wastewater) of the Final BDAT Background Document for K022. This section includes a discussion of the calculation of proposed treatment standards for organic and metal constituents in wastewater forms of K022.

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available treatment performance data, and the data must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures.

Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the chemical matrices of the samples. A complete discussion of the accuracy correction of treatment performance data is provided in Appendix A. Appendix A also contains the matrix spike recoveries and accuracy correction factors used to correct the treatment performance data, as well as the corrected treatment performance data.

After treatment performance data are corrected for accuracy, the arithmetic average of the corrected data is calculated for each regulated

constituent. In cases where the constituent is not detected in the treatment residual at or above its detection limit, the detection limit is used to calculate the average constituent concentration in the treated waste. Table 6-1 (at the end of this section) presents the averages of the corrected treatment performance data for each constituent regulated in wastewater forms of K022.

The next step in calculating treatment standards is to determine the variability factor (VF) for each regulated constituent. The variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and treatment sample analysis. (For more information on calculation of variability factors, see EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).) Variability factors for the constituents regulated in K022 wastewaters are shown in Table 6-1.

Finally, the treatment standard is calculated for each constituent proposed for regulation by multiplying the average of the corrected treatment performance values by the variability factor for the constituent. Treatment standards for wastewater forms of K022 are presented in Table 6-1 and are discussed in greater detail in the following sections.

6.1 Calculation of Proposed Treatment Standards for Organic Constituents in K022 Wastewaters

Treatment performance data for the scrubber water residual from rotary kiln incineration of K022 are not available. Therefore, the Agency is

transferring performance data from treatment of organic constituents in the surrogate U and P wastes in Test 14 (listed in Table 3-1) to develop treatment standards for organic constituents in wastewater forms of K022. The rationale for this transfer is presented in Section 3.0 of this document.

Incineration generally results in the generation of ash (a nonwastewater) and combustion gas scrubber water (a wastewater). The best measure of performance for a destruction technology, such as incineration, is the total amount of each constituent of concern remaining after treatment. Therefore, BDAT treatment standards for organic constituents in K022 wastewaters were calculated based on total constituent concentration data transferred from Test 14 scrubber water (Reference 3). However, these treatment standards apply to all forms of K022 wastewaters, not just scrubber water.

Proposed treatment standards for organic constituents in K022 wastewaters were calculated using four sample sets of data for rotary kiln incineration of the surrogate U and P wastes used in Test 14 (Reference 3). Tables 3-2 and 3-3 of this document present the total concentration of each organic constituent detected in the untreated surrogate U and P wastes and the treated wastewater residual (scrubber water). Treatment performance data for each constituent being proposed for regulation in K022 wastewaters were transferred from data for the same constituent in the wastes incinerated in Test 14 if that constituent was detected in those untreated wastes. For a constituent that was not detected in the untreated wastes incinerated in Test 14, a treatment standard was developed based on treatment performance

data from another constituent that was detected in the untreated surrogate U and P wastes that were tested.

The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect treatment performance by incineration with respect to the wastewater residual (i.e., scrubber water) and the structural similarities between the constituents from and to which data are transferred. In the secondary chamber (or afterburner), energy in the form of heat is added to destabilize chemical bonds to initiate combustion reactions. To determine whether one constituent is destabilized similarly to another constituent, the Agency examines the bond dissociation energies and the structural similarities of the constituents.

In general, the Agency believes that a constituent with a higher bond dissociation energy (BDE) is more difficult to treat than a constituent with a lower BDE. Whenever possible, treatment performance data were transferred to K022 wastewaters from constituents detected in untreated wastes incinerated in Test 14 that had equal or higher boiling points. Specific cases where data were transferred from another constituent are noted in Table 6-1 at the end of this section.

The calculation of the treatment standards for each BDAT List constituent proposed for regulation in K022 wastewaters is shown in Table 6-1.

6.2 Calculation of Proposed Treatment Standards for Metal Constituents in K022 Wastewaters

Treatment performance data for metal constituents in K022 wastewaters are not available. Therefore, the Agency is transferring performance data from treatment of K062 mixed with metal-bearing characteristic hazardous wastes using chemical precipitation followed by vacuum filtration to K022. The rationale for this transfer is presented in Section 3.0 of this document.

Chemical precipitation followed by vacuum filtration is a removal technology for metals in wastewater. The best measure of performance for a removal technology is the total amount of each constituent of concern remaining in the wastewater after treatment. Therefore, the BDAT treatment standards for metal constituents in K022 wastewaters were calculated based on total constituent concentration data; these data were transferred from treatment of K062 mixed with metal-bearing characteristic hazardous wastes (Reference 5).

Proposed treatment standards for metal constituents in K022 wastewaters were calculated using three sample sets of data for chemical precipitation followed by vacuum filtration of K062 mixed with metal-bearing characteristic hazardous wastes. Table 3-5 in Section 3.0 of this document presents the total concentrations for metal constituents in the untreated and treated K062 mixed with metal-bearing characteristic hazardous wastes. The accuracy-corrected data and treatment standard calculations for the metal

constituents proposed for regulation in K022 wastewaters are presented in Table 6-1.

Table 6-1

CALCULATION OF TREATMENT STANDARDS FOR CONSTITUENTS
PROPOSED FOR REGULATION IN WASTEWATER FORMS OF K022

BDAT List Constituent Proposed for Regulation	Constituent From Which Treatment Performance Data in Test 14 Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard (Average x VF) (ppm)
43. Toluene	Toluene	0.006	2.8	0.017
53. Acetophenone	Bis (2-ethylhexyl) Phthalate	0.013	2.8	0.036
106./219. Diphenylamine/ Diphenylnitrosamine	2-Sec-Butyl-4,6-dinitrophenol	0.013	2.8	0.036
142. Phenol	Toluene	0.033	2.8	0.091
159. Chromium (total)	Chromium (total)	0.221	1.583	0.35
163. Nickel	Nickel	0.387	1.212	0.47

7.0 ACKNOWLEDGEMENTS

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APPENDIX A

ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

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ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

The treatment performance data used to determine treatment standards for wastewater forms of K022 were adjusted to account for analytical interferences associated with the chemical matrices of the samples. Generally, treatment performance data were corrected for accuracy as follows: (1) a matrix spike recovery was determined for each BDAT List constituent detected in the untreated or treated waste; (2) an accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (percent) for that constituent; and (3) treatment performance data for each BDAT List constituent detected in the untreated or treated waste were corrected by multiplying the reported concentration of each constituent by its corresponding accuracy correction factor. The procedure for accuracy correction of the data is described in further detail below.

Matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then re-analyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking, minus the initial concentration of the constituent in the sample, and the result divided by the spike concentration of the constituent.

Matrix spike recoveries used to adjust the treatment performance data transferred to K022 wastewaters are shown in Tables A-1 and A-2. Duplicate matrix spikes were performed for some BDAT List constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two volumes from the first matrix spike and the duplicate spike. An accuracy correction factor of 1 was used when matrix spike and duplicate matrix spike recoveries both exceeded 100%, so that the data were not adjusted to concentrations below the detection limits.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the average matrix spike recoveries of the appropriate group of constituents (e.g., volatile or semivolatile organics) for which recovery data were available. In these cases, the matrix spike recoveries for all volatiles or semivolatiles from the first matrix spike were averaged. Similarly, an average matrix spike recovery was calculated for the duplicate matrix spike recoveries. The lower of the two average matrix spike recoveries of the volatile or semivolatile group was used for any volatile or semivolatile organic constituent for which no matrix spike was performed.

The accuracy correction factors for the data used to calculate treatment standards for K022 wastewaters are presented in Tables A-3 and A-4. The corrected treatment concentrations for the constituents proposed for regulation in K022 wastewaters are presented in Table A-5.

TABLE A-1

MATRIX SPIKE RECOVERIES FOR
ORGANICS IN COMBUSTION GAS SCRUBBER WATER

VOLATILE ORGANICS

Spike Constituent	Original Amount Found[a] (ppm)	Sample Result: Amount Spiked (ppm)	Sample Result: Amount Recovered (ppm)	Sample Result: Percent Recovery[b] (%)	Duplicate Sample Result: Amount Spiked (ppm)	Duplicate Sample Result: Amount Recovered (ppm)	Duplicate Sample Result: Percent Recovery[b] (%)
4. Benzene	ND	0.050	0.044	88	0.050	0.035	70
9. Chlorobenzene	ND	0.050	0.057	115	0.050	0.044	87
24. 1,1-Dichloroethene	ND	0.050	0.034	69	0.050	0.028	57
229. 4-Methyl-2-pentanone	ND	0.050	0.077	154	0.050	0.061	121
38. Methylene chloride	0.005	0.050	0.055	101	0.050	0.050	91
43. Toluene	ND	0.050	0.053	106	0.050	0.041	81
45. 1,1,1-Trichloroethane	ND	0.050	0.057	113	0.050	0.052	105
47. Trichloroethene	ND	0.050	0.057	115	0.050	0.043	86
215-217. Total Xylenes	ND	0.050	0.046	92	0.050	0.041	83

[a]For constituents not detected in the treatment residual at or above the detection limit (ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = $100 \times ((C_1-C_o)/C_t)$, where C_o is the concentration of the original amount found, C_1 is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

Source: Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma (Reference 3).

TABLE A-1 (Continued)

MATRIX SPIKE RECOVERIES FOR
ORGANICS IN COMBUSTION GAS SCRUBBER WATER

SEMIVOLATILE ORGANICS (ACID EXTRACTABLES)

Spike Constituent	Original Amount Found[a] (ppm)	Sample Result: Amount Spiked (ppm)	Sample Result: Amount Recovered (ppm)	Sample Result: Percent Recovery[b] (%)	Duplicate Sample Result: Amount Spiked (ppm)	Duplicate Sample Result: Amount Recovered (ppm)	Duplicate Sample Result: Percent Recovery[b] (%)
73. 2-sec-Butyl-4,6-dinitrophenol	ND	0.200	0.244	122	0.200	0.246	123
76. p-Chloro-m-cresol	ND	0.250	0.202	81	0.250	0.232	93
78. 2-Chlorophenol	ND	0.250	0.127	51	0.250	0.186	74
127. 4-Nitrophenol	ND	0.250	0.275	110	0.250	0.246	98
139. Pentachlorophenol	ND	0.250	0.258	103	0.250	0.278	111
142. Phenol	ND	0.250	0.100	40	0.250	0.180	72

[a]For constituents not detected in the treatment residual at or above the detection limit ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_l-C_o)/(C_t)$, where C_o is the concentration of the original amount found, C_l is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

ND - Not detected.

Source: Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma (Reference 3).

TABLE A-1 (Continued)

MATRIX SPIKE RECOVERIES FOR
ORGANICS IN COMBUSTION GAS SCRUBBER WATER

SEMIVOLATILE ORGANICS (BASE/NEUTRAL FRACTION)

Spike Constituent	Original Amount Found[a] (ppm)	Sample Result			Duplicate Sample Result		
		Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery[b] (%)	Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery[b] (%)
52. Acenaphthene	ND	0.125	0.062	50	0.125	0.068	55
70. Bis(2-ethylhexyl)-phthalate	ND	0.100	0.105	105	0.100	0.112	112
88. 1,4-Dichlorobenzene	ND	0.125	0.037	30	0.125	0.045	36
102. 2,4-Dinitrotoluene	ND	0.125	0.089	71	0.125	0.096	77
105. N-Nitroso-di-n-propylamine	ND	0.125	0.070	56	0.125	0.090	72
110. Hexachlorobenzene	ND	0.100	0.063	63	0.100	0.071	71
117. Isosafrole	ND	0.100	0.048	48	0.100	0.060	60
144. Pronamide	ND	0.100	0.025	25	0.100	0.012	12
145. Pyrene	ND	0.125	0.059	47	0.125	0.061	49
150. 1,2,4-Trichlorobenzene	ND	0.125	0.040	32	0.125	0.048	38

[a]For constituents not detected in the treatment residual at or above the detection limit ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_1-C_o)/(C_t)$, where C_o is the concentration of the original amount found, C_1 is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

ND - Not detected.

Source: Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma (Reference 3).

TABLE A-2

MATRIX SPIKE RECOVERIES FOR METALS IN WASTEWATER RESIDUALS[a]

Spike Constituent	Original Amount Found (ppm)	Amount Spiked (ppm)	Sample Result		Duplicate Sample Result	
			Amount Recovered (ppm)	Percent Recovery[b] (%)	Amount Recovered (ppm)	Percent Recovery[b] (%)
159. Chromium (total)	<0.004	0.050	0.035	70	0.034	68
163. Nickel	0.203	1.00	1.14	94	1.128	93

[a]Matrix spike recoveries were transferred from data in the Onsite Engineering Report for Horsehead (Reference 6).

[b]Percent recovery = 100 x $(C_1 - C_o)/Ct$, where C_1 = amount recovered, C_o = original amount found, and C_t = amount spiked.

Source: Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma (Reference 3).

Table A-3

SUMMARY OF ACCURACY CORRECTION FACTORS FOR ORGANIC CONSTITUENTS

BDAT List Constituent	Accuracy Correction Factor[a]
VOLATILE ORGANICS	
38. Methylene chloride	1.099
229. Methyl isobutyl ketone	1.000
43. Toluene	1.235
45. 1,1,1-Trichlonethane	1.000
SEMIVOLATILE ORGANICS	
70. Bis(2-ethylhexyl)phthalate	1.000
73. 2-sec-Butyl-4,6-dinitrophenol	1.000
117. Isosafrole	2.083
122. 1,4-Naphthoquinone	1.887
142. Phenol	2.500

[a]The accuracy correction factor is equal to 100 divided by the percent recovery. An accuracy correction factor of 1 was used when matrix spike and duplicate matrix spike recoveries both exceeded 100%, so that the data were not adjusted to concentrations below the detection limits.

Table A-4

SUMMARY OF ACCURACY CORRECTION FACTORS FOR METAL CONSTITUENTS[a]

BDAT List Constituent		Accuracy Correction Factor[b]
154.	Antimony	--
155.	Arsenic	--
156.	Barium	--
157.	Beryllium	--
158.	Cadmium	--
159.	Chromium (total)	1.471
221.	Chromium (hexavalent)	--
160.	Copper	--
161.	Lead	--
162.	Mercury	--
163.	Nickel	1.075
164.	Selenium	--
165.	Silver	--
166.	Thallium	--
167.	Vanadium	--
168.	Zinc	--

[a]The data used to calculate these accuracy correction factors were transferred from data in the Onsite Engineering Report for K061 (Reference 7).

[b]The accuracy correction factor is equal to 100 divided by the percent recovery.

Table A-5

ACCURACY-CORRECTED DATA USED TO CALCULATE TREATMENT STANDARDS FOR CONSTITUENTS PROPOSED FOR REGULATION IN K022 WASTEWATERS

BDAT List Constituent	Corrected Total Concentration[a] in the Test 14 Combustion Gas Scrubber Water (ppm)			
Sample Set:	1	2	3	4
VOLATILE ORGANICS				
38. Methylene chloride	0.005	0.005	0.005	0.005
229. Methyl isobutyl ketone	0.01	0.01	0.01	0.01
43. Toluene	0.006	0.006	0.006	0.006
45. 1,1,1-Trichloromethane	0.005	0.005	0.005	0.005
SEMIVOLATILE ORGANICS				
70. Bis(2-ethylhexyl)phthalate	0.013	0.013	0.013	0.013
73. 2-sec-Butyl-4,6-dinitrophenol	0.013	0.013	0.013	0.013
117. Isosafrole	0.027	0.027	0.027	0.027
122. 1,4-Naphthoquinone	0.025	0.025	0.025	0.025
142. Phenol	0.033	0.033	0.033	0.033

BDAT List Constituent	Corrected Total Concentration[a] in the Treated K062 Wastewater Mixture (ppm)[a]		
Sample Set:	1	2	3
METALS			
159. Chromium (total)	0.221	0.176	0.265
163. Nickel	0.387	0.355	0.419

[a]Constituent concentrations have been corrected by multiplying the concentration by the accuracy correction factor (ACF) for each constituent.